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Bouvet

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[54] **MACERATION SYSTEM FOR MILLING SUGAR CANE**

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[51] **Int. Cl.**[3] **C13D 1/10;** C13C 3/00

[52] **U.S. Cl.** ..... **127/6;** 127/5; 100/70 A; 100/74; 100/75; 100/121

[58] **Field of Search** ..... 100/73, 74, 75, 70 A, 100/121; 127/6, 2, 3, 4, 5

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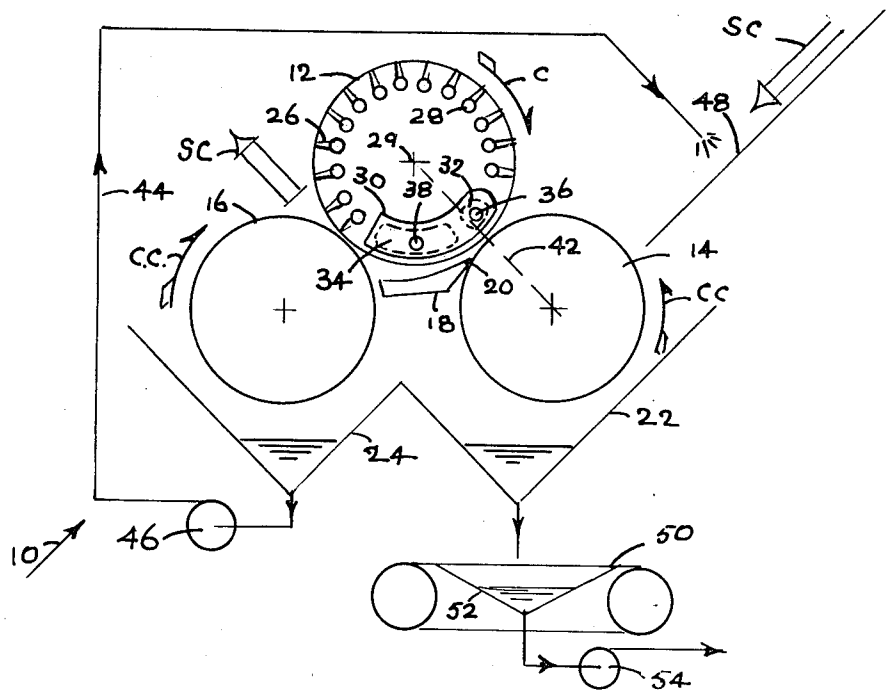
Attorney, Agent, or Firm—Melvin R. Stidham

[57] **ABSTRACT**

Disclosed is a maceration system of the type generally used in the grinding and juice extraction of sugar cane. The last mill has a roll and feed and discharge bottom rolls with elongated trash plate spanning the space between the bottom rolls. Separate troughs extend below each of the bottom rolls to catch and separate juice therefrom. The top roll has longitudinal flow passageways around it opening into ports in the roll surface and water is introduced through these passgeways to flow into the pulp moving over the trashplate to the discharge roll, and the juice from below the discharge roll is directed to the pulp moving to the feed roll. In the case of multiple mills in tandem, the juice recovered from the feed roll is directed to the top roll passageways of the previous mill and the juice from the discharge roll of that mill is directed to the feed roll thereof.

6 Claims, 4 Drawing Figures



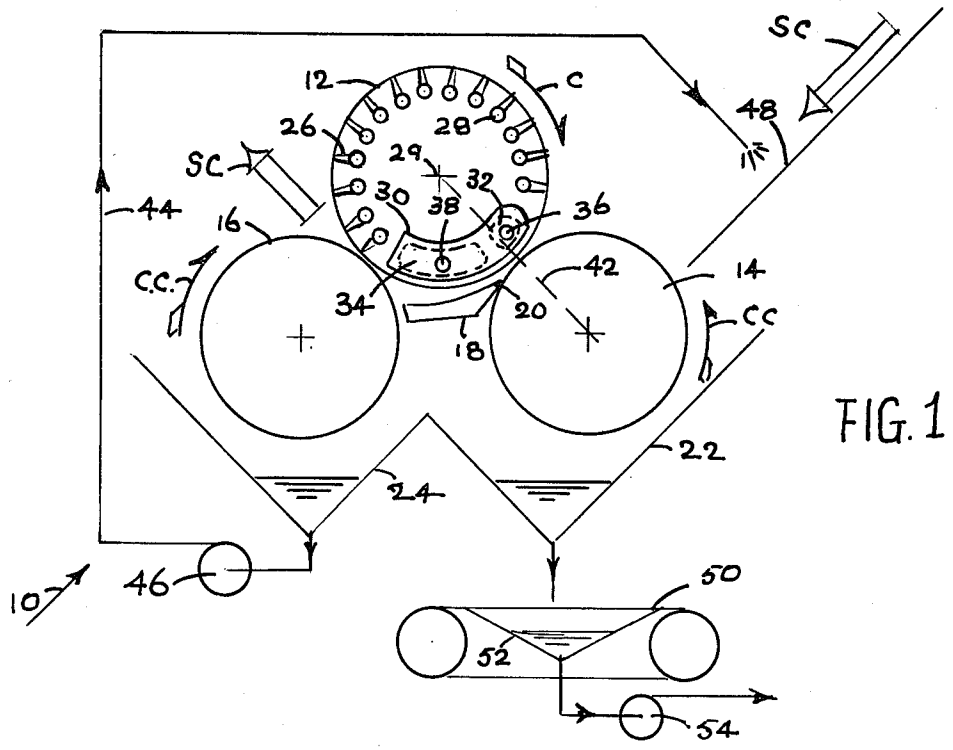


FIG. 1

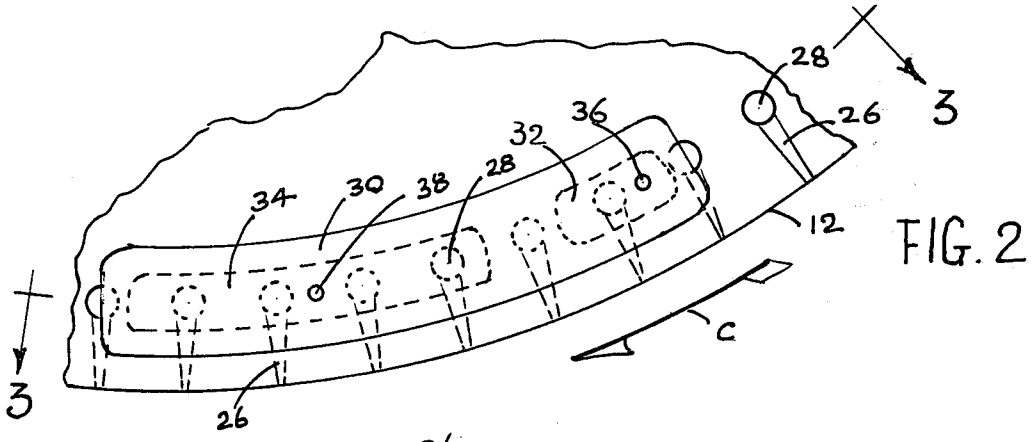


FIG. 2

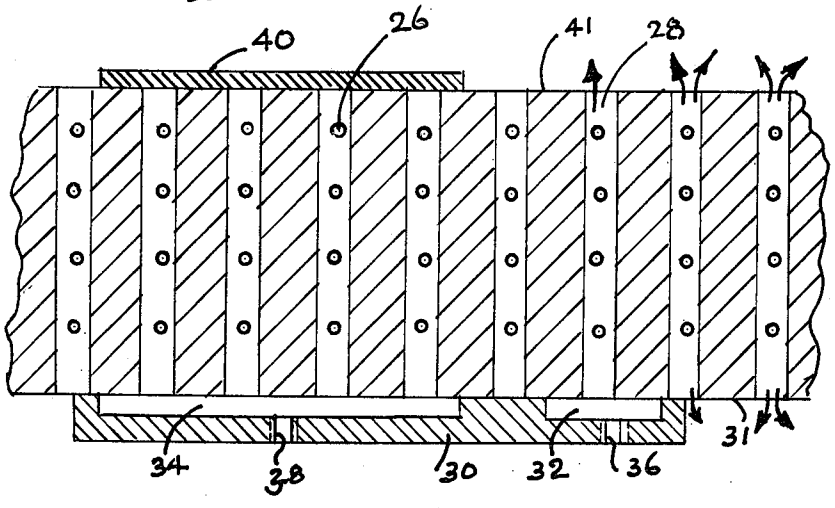


FIG. 3

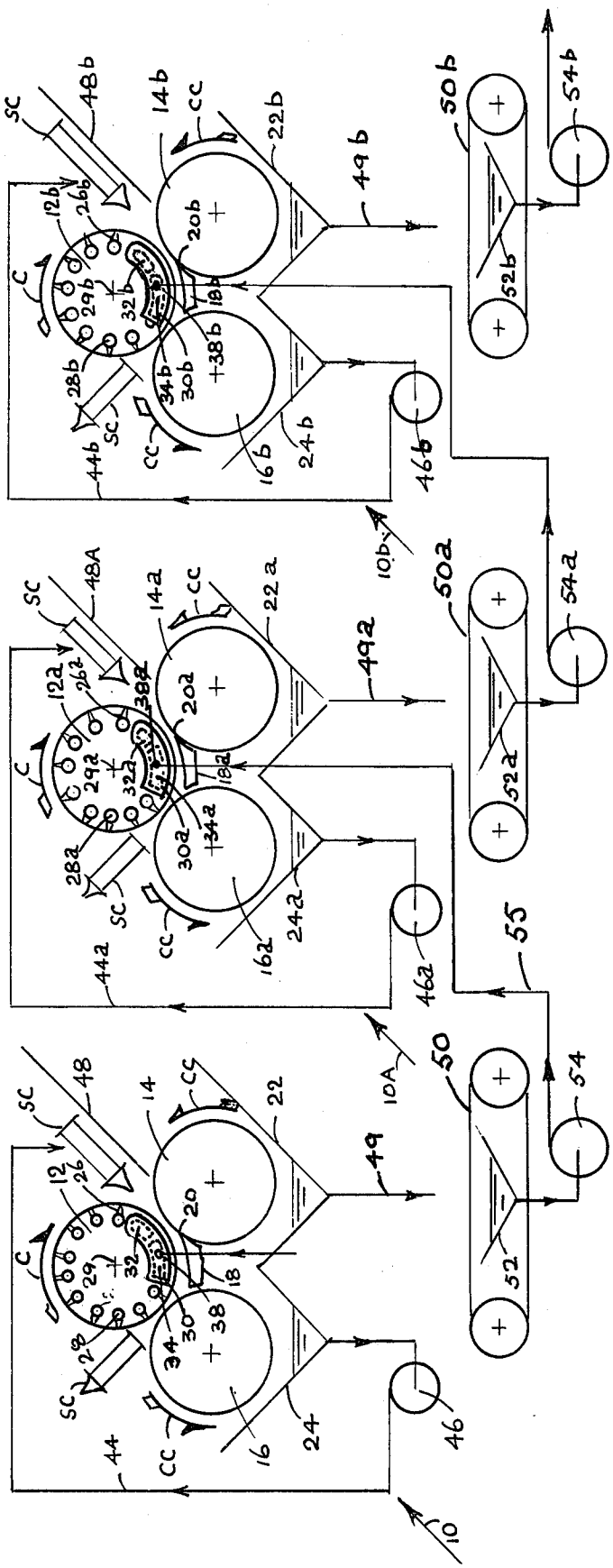

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FIG 4

MACERATION SYSTEM FOR MILLING SUGAR CANE

BACKGROUND OF THE INVENTION

This invention is directed to a maceration system used in the grinding and juice extraction of sugar cane and the like by the milling process. It is generally accepted in the industry that the most effective type of maceration is the so called, "Compound Maceration" system whereby the imbibition water is added to the bagasse blanket as it enters the last mill of the milling tandem, and all of the liquid collected from beneath the three rolls of that mill is delivered as maceration onto the pulp or bagasse blanket entering the preceding mill of the tandem. This same process is repeated in turn for each mill in a tandem until the totality of the maceration extracted by all of the mills of the tandem appears as the liquid extracted by the first mill of the tandem as "mixed juice" which is further processed in another section of the sugar factory.

It is generally accepted in the cane sugar industry that the amount of sugar juice recovered from the individual mills of the tandem, as well as by the tandem in its entirety, is directly proportional to the amount of washing given to the bagasse material by the maceration system as it proceeds through the mill tandem. However, in the conventional maceration system, the maximum number of washes is limited to one per mill and, in addition, the flow of maceration liquid is restricted in such systems because of inadequate drainage channels for the juice.

OBJECTS OF THE INVENTION

It is an object of this invention to provide a maceration system wherein the amount of washes given to a tandem of mills is greatly increased.

It is a further object of this invention to provide a maceration system wherein each mill unit in a tandem thereof may receive two washes.

Other objects and advantages of this invention will become apparent from the description to follow, particularly when read in conjunction with the accompanying drawings.

SUMMARY OF THE INVENTION

In carrying out this invention I provide a maceration system having a tandem of three roll mills, with at least the top mill roll being constructed in accordance with my U.S. Pat. No. 3,969,802 granted July 20, 1976 for "Mill Roll". There, the roll has longitudinal passageways around it and below the surface, with generally radial openings extending from the surface inward to the longitudinal passageways so that juices extracted from the pulp are conducted through the passageways to discharge at the ends of the roll, thereby greatly increasing the efficiency of the mill and its capacity for juice extraction. In each mill of the tandem, there is a top roll and feed and discharge bottom rolls, with a trash plate spanning the space between the bottom rolls, over which pulp is transported in the transition between the two grinding stages of the mill. Separate troughs are disposed beneath the feed and the discharge rolls to collect juice squeezed thereby. Imbibition water is introduced through the longitudinal passageways in the top roll of the last mill from one end thereof. The other end is blocked off so that the liquid exits through the radial openings to discharge on the pulp moving over the trash plate to the discharge roll. The relatively thin juice below the discharge roll is ducted to the pulp moving to the feed roll, and the slightly denser juice from the trough below the feed roll is ducted to an end of the longitudinal passageways in the top roll of the next previous mill and discharge on the pulp moving over the trash plate between the feed and discharge rolls there. Hence, in each mill, in the tandem, the thinner maceration liquid is delivered to the longitudinal roll passageways to mix with the pulp moving over the trash plate, and the slightly denser juice recovered from this wash is delivered to the pulp entering the feed roll. The densest juice collected from the feed roll is delivered to the longitudinal passages in the top roll of the next previous mill. In the case of the last mill the "thinner liquid" is the imbibition water; in the case of other mills, it is the liquid from below the feed roll of the next succeeding mill.

BRIEF DESCRIPTION OF THE DRAWING

In the drawings, in which like characters of reference designate like parts throughout the several views thereof;

FIG. 1 is a schematic digram of the maceration system of this invention as it applies to the last mill of milling tandem;

FIG. 2 is a partial plan view of the header which is a feature of this invention;

FIG. 3 is a section view taken along line 3—3 of FIG. 2; and

FIG. 4 is a schematic diagram of the maceration system as it applies to a complete milling tandem;

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to FIG. 1 with greater particularity there is shown the last mill **10** of a juice extraction system which may have several mills in tandem, as will be described. Of course, where just one mill is employed, the only mill is the "last mill". In any event, the mill comprises a top mill roll **12** and feed and discharge bottom rolls **14** and **16**. As indicated by the arrows the top roll rotates in one direction C, i.e. clockwise in FIG. **1**, while the lower rolls rotate in the opposite, counterclockwise direction C.C. The sugar cane or other pulp from which juice is extracted, moves in the direction of the arrows S.C., first between the feed and top roll **14** and **12**, and then between the discharge and top rolls **16** and **12**, and in the transition stage, the sugar cane or bagasse passes over a trash plate **18** spanning the space between the two lower mill rolls. The pulp mass is stripped from the lower feed roller **14** by the leading edge **20** of the trash plate **18**.

Separate troughs **22** and **24** are disposed beneath the feed and discharge rolls **14** and **16**, so that juices of progressively less density are collected separately.

At least the top roll **12**, and preferably both the top and discharge lower rolls **12** and **16**, are constructed in accordance with my U.S. Pat. No. 3,969,802 wherein a series of perforations or ports **26** extending in rows across the rolls **12** open into longitudinal passageways **28** which extend around and generally parallel to the roll axis **29** of the rolls **12** and **16**, whereby juice squeezed from the pulp S.C. is carried through the perforations **26** and passageways **28** to be discharged from the ends of the roll **12** and into the troughs **22** and **24**. This greatly increases the juice extraction capacity

of the system and enables it to accommodate the increased liquid circulation of the present invention.

As a particular feature of this invention an arcuate, compartmented stationary header **30** (FIGS. **2** and **3**) is pressed by any suitable means (not shown) to seal against the circular end **31** of the top roll **12**. The header is divided into two arcuate compartments **32** and **34** which seal around the ends of the longitudinal passages **28** in the roll **12** as they rotate through. The compartment **32** is connected at **36** to a source of steam, and the compartment **34** is connected at **38** to a source of imbibition water (not shown). A seal plate **40** is pressed against the opposite end **41** of the roll **12** to cover those longitudinal passageways embraced by the liquid dispensing compartment **34** of the header **30**.

In operation, as each longitudinal roll passageway **28** moves into the gas distributing compartment **32** of the header **30**, a charge of gas, preferably steam blows completely through that passageway **28** to force out any liquid remaining from the first milling stage wherein the pulp was compressed between rolls **12** and **14**. It is understood that the term "gas" as used herein is broad enough to include steam, as well as compressed air, although steam is the preferred medium. The first compartment **32** is situated in the end portion of the first compression stage where the converging space between the rolls **12** and **14** passes through in common centerline **42** of the two rolls.

Thereafter, the space gradually enlarges, and it is in this decompression stage that the second compartment **34** is located for introduction of maceration fluid into the passageways **28** embraced thereby. Because the opposite ends of these passageways are blocked by seal plate **40**, the liquid is forced out through to ports **26** and onto the bagasse on the trash plate **18**. Since the bagasse is in an expanding mode following maximum compression, it readily absorbs the maceration liquid.

It is important that the compartment **34** be located at the very beginning of the expansion stage so that liquid, and not air, will enter the expanding, previously crushed cells which contained the sugar juices. For the same reason, steam is the preferred medium for blasting through from the first compartment **32**.

A duct system **44** pumps fluid at **46** from the last mill discharge roll trough **24** onto the pulp S.C. entering the feed end of the mill between feed rolls **14** and top roll **12**. Hence, each mill in a tandem is subjected to two washings, first by the less dense of two liquids available, by flowing at **38** through the header compartment **34**, longitudinal passageways **28** and ports **26** onto the pulp on the trash plate **18**, and second by the somewhat more concentrated fluid collected at the trough **24** and delivered at the feed **42**. In the case of the last mill **10** in a system, the thinner fluid being introduced at header **30** is the imbibition water. This is twice the number of washings in the conventional system, which has just one wash per mill.

Referring now to FIG. **4**, there is shown a multi-mill system in tandem including, in addition to the last mill **10** an intermediate or penultimate mill **10A** and a preliminary or first mill **10B**, the components of the intermediate **10A** and preliminary mill **10B** being numbered the same as corresponding components in the last mill **10** with the addition of the letters "a" and "b", respectively, after the corresponding reference numerals.

Again, the imbibition water is introduced at header chamber **34** through the last mill top roll **12** and the relatively light liquid from the final discharge trough **24** is delivered to the feed end **48** of the last mill **10**. At the same time, the slightly denser liquid is removed at **49** from the feed roll trough **22** and screened through a cush-cush strainer **50** to a collecting trough **52**, in accordance with the conventional practice. However, in accordance with this invention, the liquid so strained is then pumped at **54** through the duct circuit **55** to the imbibition inlet **38*a*** where it is delivered at header liquid chamber **34*a*** and discharged into pulp being passed to the discharge and top rolls **16*a*** and **12*a***, of the penultimate mill **10A**.

Similarly in the second unit the lighter of two fluids being collected, that in trough **24*a***, but slightly more concentrated than that delivered at the header **34*a*** from the last mill **10**, is delivered to the pulp S.C. at the feed roll **14*a*** and the more concentrated fluid in trough **22*a*** is delivered to the header **34*b*** in the preliminary mill **10B**. There, the lighter fluid being collected in trough **24*b*** is delivered to the feed rolls **12*b***, **14*b*** and the most concentrated fluid in the system is screened at **50*b***; delivered to the trough **52*b*** and then is pumped away at **54*b*** for treatment at another area of the plant.

While this invention has been described in conjunction with a preferred embodiment thereof, it is obvious that modifications and changes therein may be made by those skilled in the art without departing from the spirit and scope of this invention, as defined by the claims appended hereto.

Having described my invention, I claim:

1. In a juice extracting maceration system comprising:

a mill having:

a top mill roll, said top mill roll having a plurality of longitudinal rows of perforations around the cylindrical surface thereof and a plurality of longitudinal passageways through and around said roll below the surface thereof said passageways being in flow communication with said rows of perforations so that juice squeezed from pulp will flow first radially into said perforations and then laterally through said longitudinal passageways;

feed and discharge bottom mill rolls, each disposed cooperatively with said top mill roll to mill pulp between it and said top mill roll;

a trash plate substantially spanning the space between said feed and discharge bottom rolls over which crushed pulp is transported;

a first trough underlying said discharge mill roll to catch juice squeezed from pulp between it and said top mill roll; and

a second trough underlying said feed mill roll to catch juice squeezed from pulp between it and said top mill roll;

a wash system comprising:

a stationary header in slidable sealing engagement with one end of said top mill roll;

a liquid distributing compartment defined in said header;

peripheral walls defined in said header, located around said liquid distributing compartment and embracing at all times the entrance to at least one of said longitudinal passageways;

a stationary blocking member engaging the other end of said top mill roll in alignment with said stationary header to prevent flow of liquid from said at least one longitudinal passageway; and

means for introducing a liquid to said liquid distributing compartment with the system being arranged

such that the introduced liquid flows first laterally through said at least one flow passageway and then radially out through the row of perforations connected thereto and onto crushed pulp on said trash plate.

2. The maceration system defined by claim 1 wherein:

said liquid distributing compartment is situated closely downstream of the maximum zone of compression between said top mill roll and said feed mill roll.

3. The maceration system defined by claim 1 wherein:

said liquid distributing compartment is of arcuate configuration and long enough to embrace at all times several of said longitudinal passageways beginning closely downstream of the maximum zone of compression between said top mill roll and said feed mill roll.

4. The maceration system defined by claim 1 where in said stationary header includes:

a gas distributing compartment defined in said header and embracing at all times at least one other of said longitudinal passageways immediately upstream from that passageway embraced by said liquid distributing compartment; and

means for introducing a pressurized gas to said gas distributing compartment to evacuate a longitudinal passageway embraced thereby.

5. The maceration system defined by claim 1 including:

means defining a port opening into said water distributing compartment;

first duct means for conducting water to said port;

second duct means to conduct liquid from said first trough to discharge same onto the path of pulp moving to said feed mill roll; and

a pump in said second duct means.

6. The maceration system defined by claim 4 wherein said mill is the last mill in a tandem array of mills and including:

a penultimate mill having a penultimate top mill roll;

said penultimate top mill row having a plurality of longitudinal rows of performation around the cylindrical surface and a plurality of passageways through and around said penultimate top roll below the surface thereof, each of said rows of perforations opening into one of said passageways;

penultimate feed and discharge bottom mill rolls, each disposed cooperatively with said top roll to mill pulp between it and said penultimate top mill roll;

a penultimate mill trash plate substantially spanning the space between said feed and discharge bottom mill rolls over which crushed pulp is transported;

a third trough underlying said penultimate discharge mill roll to catch juice squeezed from pulp between it and said penultimate top mill roll;

a fourth trough underlying said preliminary feed mill roll to catch juice squeezed from pulp between it and said penultimate top mill roll;

a penultimate stationary header engaging one end of said penultimate top mill roll;

a penultimate water distributing compartment in said header embraching at all times at least one of said longitudinal passageways;

a penultimate blocking member engaging the other end of said penultimate top mill roll; and

means defining a second port opening into said penultimate water distributing compartment;

third duct means for directing the juice from said second trough to said second port;

fourth duct means for conducting juice from said third trough to pulp moving to said penultimate feed mill roll; and

pumps in said third and fourth ducts.

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